ORIGINAL ARTICLE

ISSN (Print): 2517-9675
ISSN (Online): 2518-2625

GROWTH AND YIELD PERFORMANCE OF TWENTY WHEAT GENOTYPES IN SEMIARID CLIMATE OF SARGODHA, PAKISTAN

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Keywords:
Growth, genotypes, grain yield, plant height, spikelets, wheat

ABSTRACT

Background Plant species and genotypes within species may vary widely in their potential to produce yield under different agro-climatic conditions. The present study was planned to investigate the growth and yield performance of twenty wheat genotypes in the semiarid climate of Sargodha, Pakistan.

Methodology Twenty different spring wheat genotypes viz., SA-42, YECORA-70, CHENAB-70, BARANI-70, LAYALPUR-73, PARI-73, SANOAL-73, SA-75, PB-76, PB-81, KOHINOOR-83, BARANI-83, FSD-83, FSD-85, PB-85, CHAKWAL-86, PASBAN-90, ROHTAS-90, INQLAB-91 and PARWAZ-94 were grown under field conditions in semi-arid climate of Sargodha district. Experiment was planned according to Randomized Complete Block Design with three replications.

Results Wheat genotypes were markedly differed in term of growth and yield characteristics including plant height, days to heading, days to maturity, spike plant^{-1}, spikelets spike^{-1}, grain yield and 1000-grain weight. On the basis of grain yield plant^{-1}, PARWAZ-94 showed highest grain yield followed by CHENAB-70 and INQLAB-91 in descending order.

Conclusion Among the tested twenty wheat genotypes, three genotypes CHENAB-70, INQLAB-91 and PARWAZ-94 were the good performer. These wheat genotypes could be used for future breeding programs to find high yielding wheat genotypes for agro-climatic conditions of Sargodha district in Pakistan.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the staple food of more than one-third world's population including Pakistan due to its nutritional importance, range of uses and storage qualities (Kaleem et al. 2017). Nutritional value of wheat flour has a major role in human diet (Rasaei et al. 2017). Wheat grains have carbohydrates 60-80% mostly in the form of starch, moisture 12%, fats 1.5-2%, proteins 8-15% (Anjum et al. 2005). As a staple food, wheat is fulfilling the calorie demands of growing population (Kandhare 2014) and around 4.5 billion people from 94 developing countries are using wheat as a major source of their food calories (21%) and protein (20%) (Braun et al. 2010). The climate is changing and scarcity of water along with increasing temperature has emerged a big challenge for sustaining wheat productivity, particularly in arid and semi-arid climates.

Wheat is one of the most important cereal crops that is grown on large scale across the world due to its widespread acceptability, consumption and its nutrition as well as economic importance (Rasaei et al. 2017). All around the world, it is grown on an area of 222.24 million hectares with production of 737.83 million metric tons (USDA 2017). In Pakistan, wheat contributes 1.7% in gross domestic product and 9.1% in value addition. Wheat is sown on area of 8734 thousand hectares (GOP 2017-18). The average grain yield in Pakistan is far below than its potential which may be attributed to several factors (Ahmad et al. 2018).

The major factors responsible for low average grain yield of wheat in Pakistan that might include temperature variations, poor understanding about

Cite As: Shaukat S, R Shukat, I Kousar, A Ali, N Akhtar, M Nadeem, A Ullah, M Arsalan, Z Aslam (2020) Growth and yield performance of twenty wheat genotypes in semi-arid climate of Sargodha, Pakistan. *J. Environ. Agric.*, 5(1): 452-454.

variety selection, shortage of good quality seed, lack of advance technology, late sowing, irrigation problems, heat and drought stress. Among all these stresses, heat stress is the main hazard to crop yield especially at the reproductive stage (Hall 2001).

For development and improvement of different genotypes, plant breeders exploit available genetic resources of wheat. Screening of wheat genotypes is mainly based on diversity among agro-morphological, physiological as well as quality parameters that can perform better in all environmental conditions. Exploitation of many physiological traits is however yet needed. The present investigation was planned with the main objective of cataloguing of different wheat genotypes with respect to yield and yield components.

MATERIALS AND METHODS

Experimental material for current research included twenty different spring wheat genotypes viz., SA-42, YECORA-70, CHENAB-70, BARANI-70, LAYAL-PUR-73, PARI-73, SANOAL-73, SA-75, PB-76, PB-81, KOHINOOR-83, BARANI-83, FSD-83, FSD-85, PB-85, CHAKWAL-86, PASBAN-90, ROHTAS-90, INQLAB-91 and PARWAZ-94. These twenty wheat genotypes were sown in accordance with Randomized Complete Block Design (RCBD) with three replications at Research area of College of Agriculture, University of Sargodha, Pakistan. Plot size was 10 × 4 ft^2. Recommended dose of fertilizers 160 kg ha^{-1} nitrogen as urea, 120 kg ha^{-1} P_2O_5 as triple superphosphate and 90 kg ha^{-1} K_2O as sulfate of potash were applied. Whole of P_2O_5 and K_2O were applied at the time of sowing while nitrogen in three equal splits. Normal agronomic and cultural practices were carried uniformly. At maturity, data were recorded for different traits like, plant height, days to heading, days to maturity, number of spikes $plant^{-1}$, number of grains $spike^{-1}$, 1000-grain weight and grain yield $plant^{-1}$. The data collected for different yield and its components were analyzed to analysis of variance (ANOVA) to find out the significance level for all the genotypes.

RESULTS AND DISCUSSION

For the development of high yielding varieties with new and diverse range of genetic material and improvement of existing varieties, plant breeders should have complete understanding for the inheritance pattern of yield as well as yield related traits in the diverse range of environmental conditions. Identification of the better parents with required morphological and physiological performance is vital in the segregating generation. Mean data for all the traits of twenty wheat genotypes under study is presented in Table 1. The results revealed marked differences among twenty wheat genotypes in term of yield and yield related parameters. Kahrizi et al. (2010) reported that successful breeding depends upon variation among the germplasm. The main concern for breeding material focuses on yield of the genotypes.

Table 1 Growth and yield performance of twenty wheat genotypes in semiarid climate of Sargodha, Pakistan

Genotype Name	Plant height (cm)	Days to heading	Days to maturity	Spikelets $plant^{-1}$	Grains $spike^{-1}$	Grain yield $plant^{-1}$	1000 grain weight (g)
SA-42	98.33	102.67	130.00	15.00	54.67	22.64	38.00
YECORA-70	97.33	98.67	134.33	18.33	54.00	22.99	40.33
CHENAB-70	100.33	98.33	130.00	22.33	58.33	26.10	47.00
BARANI-70	96.67	103.33	124.67	17.67	54.33	22.20	43.00
LAYALPUR-73	92.00	98.67	127.00	13.00	55.00	20.61	38.67
PARI-73	99.00	102.33	124.00	16.33	55.67	22.36	40.33
SANOAL-73	95.67	99.33	123.33	17.00	56.00	23.27	38.33
SA-75	97.33	102.00	128.00	15.67	59.00	21.32	38.33
PB-76	101.33	98.33	129.33	19.67	55.67	24.88	40.33
PB-81	93.33	104.00	126.33	17.67	55.67	23.20	42.00
KOHINOOR-83	88.33	90.67	131.33	22.33	55.67	24.27	40.67
BARANI-83	92.00	101.67	130.00	17.00	56.67	20.20	39.33
FSD-83	89.67	99.00	131.67	19.00	54.67	21.58	44.00
FSD-85	98.00	94.00	122.67	14.33	54.67	23.86	40.67
PB-85	103.00	98.67	132.00	15.67	53.67	21.85	40.00
CHAKWAL-86	95.33	100.67	129.33	17.00	56.33	22.13	45.00
PASBAN-90	100.33	100.00	128.67	15.67	55.67	23.03	39.67
ROHTAS-90	95.33	98.33	133.33	22.33	55.33	20.13	38.67
INQLAB-91	90.33	100.67	126.00	20.33	60.00	25.55	44.67
PARWAZ-94	92.00	98.00	125.67	22.33	60.00	26.13	46.67

Table 2 ANOVA table showing significant differences among all traits of twenty wheat genotypes under study

SOV	DF	Plant height (cm)	Days to heading	Days to maturity	Spikelets plant^{-1}	Grains spike^{-1}	Grain yield plant^{-1}	1000-grain weight (g)
Replication	2	6.066	3.016	0.516	2.466	6.450	0.549	2.916
Genotype	19	51.097**	29.031**	33.588**	24.336*	10.509*	9.744**	23.869**
Error	38	3.610	3.8763	3.288	9.484	4.853	1.998	3.495

The yield potential was analyzed by analysis of variance of yield related traits. All of the genotypes under study depicted highly significant differences as presented in Table 2.

Wheat genotypes CHENAB-70, INQLAB-91 and PARWAZ-94 performed best among all the twenty genotypes and showed maximum values for number of spikelets spike^{-1}, number of grains spike^{-1}, grain yield plant^{-1} and 1000-grain weight. Genetic variation is a pre-basic requirement for successful running of crop improvement that mainly depended on its magnitude for desired heritability of desired traits as studied by Kahrizi et al. (2010). In case of wheat, yield and yield related characters could play a key role to assess the performance of wheat genotypes (Anwar et al. 2011). Climate change caused significant reduction of plant height by rapid phase change, ultimately resulting in shortening of vegetative period and inducing early maturity (VollenWeider and Gunthardt-Goerg 2005).

Spikelets spike^{-1} played an important role in wheat yield improvement. It could be due to the fact that spikelets bear the grain and more spikelets produced more grain yield which ultimately gave more yield of wheat. Increase of grains spike^{-1} resulted in more grain yield which is the ultimate breeding objective of any crop breeding. In the present research, our findings revealed that high temperature could affect the development of wheat spike and grain yield. These results were similar to the findings of Saini and Aspinall (1982) as they showed that increased number of grains spike^{-1} could contribute towards higher yield.

CONCLUSION

Significant variations were found for yield and yield related traits in twenty wheat genotypes. CHENAB-70, INQLAB-91 and PARWAZ-94 performed best and could be utilized in further breeding programs.

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